WHAT IS CLAIMED IS:

[c01] 1. A system for laser shock peening a workpiece having a confinement fluid film thereover, comprising:

a peening laser for projecting a pulsed laser beam at a target site on said fluid film atop said workpiece;

a monitor to monitor said film at said target site, said monitor including a probe laser for projecting a probe laser beam at said target site and an optical detector optically aligned with said target site for detecting reflection of said probe beam therefrom; and

a controller operatively coupled to said peening laser and detector for initiating said pulsed laser beam in response to quality of said monitored film.

[c02] 2. A system according to claim 1 wherein said peening laser includes an optically pumped laser rod and a Q-switch for generating said pulsed beam at a pulse repetition rate, said controller being operatively coupled to said Q-switch for emitting said pulsed beam in response to quality of said monitored film.

[c03] 3. A system according to claim 2 wherein:

said peening laser further includes a driver for said Q-switch; and

said system further includes a master clock for producing a clock signal to effect said pulse rate;

said controller being configured to enable said driver when said detector detects that quality of said film is normal and to disable said driver when said detector detects that quality of said film is abnormal.

[c04] 4. A system according to claim 3 including a logical AND gate operatively coupled to said detector and said Q-switch driver for enabling said driver

when said detector produces a relatively high voltage and disabling said driver when said detector produces a relatively low voltage.

[c05] 5. A system according to claim 3, further comprising:

a focusing lens optically aligned between said detector and said target site;

a pinhole aperture optically aligned between said detector and said lens; and

a band-pass optical filter optically aligned between said detector and said aperture.

[c06] 6. A system according to claim 5 wherein said pulse repetition rate of said peening laser is at least 10 cycles per second.

[c07] 7. A system according to claim 3, further comprising:

a plurality of optical detectors in a plane array for detecting images; and

an imaging lens optically aligned between said array of optical detectors and said target site for focusing an image of said target site on said array of optical detectors.

[c08] 8. A system according to claim 7 wherein said controller is configured for measuring distance between a first reflection of said probe beam from the surface of said film and a second reflection of said probe beam from the surface of said workpiece below said film.

[c09] 9. A system according to claim 8 wherein said controller is configured for determining thickness of said film at said target site from the measured distance, and for enabling said Q-switch driver when film thickness is sufficient to conduct efficient peening and disabling said Q-switch driver when film thickness is insufficient to conduct efficient peening.

[c10] 10. A system according to claim 8, further comprising a focusing lens optically aligned between said probe laser and said target site for focusing said probe beam at said target site.

[c11] 11. A system according to claim 10 wherein said imaging lens comprises a plurality of cooperating lenses for inverting said target site image on said detection array.

[c12] 12. A system for laser shock peening a workpiece having a confinement fluid film thereover, comprising:

means for projecting a pulsed laser beam at a target site on said fluid film atop said workpiece;

means for monitoring said film at said target site by reflecting and detecting a probe laser beam from said target site; and

means for controlling said pulsed laser beam in response to the condition of said monitored film.

[c13] 13. A system according to claim 12 wherein the projecting means include a Q-switched laser for generating said pulsed beam at a pulse repetition rate, and the controlling means selectively enables Q-switching for a normal film at said target site in response to the monitoring means.

[c14] 14. A system according to claim 13 wherein said controlling means are further effective for logically coupling said monitoring means and said projecting means for enabling Q-switching for said normal film and disabling Q-switching for abnormal film at said target site in response to said monitoring means.

[c15] 15. A system according to claim 14 wherein said controlling means are further effective for synchronizing said monitoring means to said repetition pulse rate of said projecting means.

[c16] 16. A system according to claim 14 wherein said controlling means are effective for controlling said projecting means in response to relative magnitude of the detected probe beam reflected from said target site, with high magnitude corresponding with said normal film and low magnitude corresponding with said abnormal film.

[c17] 17. A system according to claim 14 wherein said monitoring means are effective for measuring thickness of said film at said target site, with sufficient thickness to conduct efficient peening corresponding with said normal film, and insufficient thickness to conduct efficient peening corresponding with said abnormal film.

[c18] 18. A method for laser shock peening a workpiece having a confinement fluid film thereover, comprising:

projecting a pulsed laser beam at a target site on said fluid film atop said workpiece;

monitoring said film at said target site by reflecting and detecting a probe laser beam from said target site; and

controlling said pulsed laser beam in response to condition of said monitored film.

[c19] 19. A method according to claim 18 wherein said pulsed laser beam is generated in a Q-switched laser and said laser is controlled by selectively enabling Q-switching for a normal film at said target site in response to monitoring said film at said target site.

[c20] 20. A method according to claim 19, further comprising logically coupling the monitoring and projecting functions for enabling said Q-switching for said normal film and disabling said Q-switching for abnormal film at said target site in response to the monitoring function.

[c21] 21. A method according to claim 20 further comprising monitoring relative magnitude of the detected probe laser beam reflected from said target site, with high magnitude corresponding with said normal film and low magnitude corresponding with said abnormal film.

[c22] 22. A method according to claim 20, further comprising monitoring thickness of said film at said target site, with sufficient thickness to conduct efficient peening corresponding with said normal film, and insufficient thickness to conduct efficient peening corresponding with said abnormal film.